

reaction is conducted for a period of time sufficient for said surface modification agent to produce a treated nanoporous silica film having a dielectric constant of about 3 or less.

4. (Amended) The [process of claim 1] dielectric film of claim 3 that produces a nanoporous silica film having a dielectric constant ranging from about 1.1 to about 3.0.

5. (Amended) The [process of claim 1] dielectric film of claim 20 wherein said reaction is conducted at a temperature ranging from about 10°C to about 300°C.

6. (Amended) The [process of claim 1] dielectric film of claim 20 wherein said reaction is conducted for a time period ranging from about 10 seconds to about 1 hour.

7. (Amended) The [process of claim 1] dielectric film of claim 20 wherein said surface modification agent is a polymer or oligomer that comprises functional groups that will react with silanols.

8. (Amended) The [process of claim 1] dielectric film of claim 7 wherein said surface modification agent is prepared by reacting a suitable monomer with water in a solvent to form said surface modification agent.

9. (Amended) The [process of claim 1] dielectric film of claim 2 wherein said solvent or co-solvent is selected from the group consisting of ethers, esters, ketones, glycol ethers, hydrocarbons, chlorinated solvents, low viscosity siloxanes and combinations thereof.

10. (Amended) The [process of claim 1] dielectric film of claim 2 wherein said co-solvent is selected from the group consisting of ethers, esters, ketones, glycol ethers, hydrocarbons, chlorinated solvents, low viscosity siloxanes and combinations thereof.

11. (Amended) The [process of claim 1] dielectric film of claim 8 wherein said monomer is selected from the group consisting of a siloxane, a silazane, a silane, a carbosilane, and combinations thereof.

12. (Amended) The [process of claim 1] dielectric film of claim 8 wherein said water is present in said co-solvent in a concentration ranging from about 0.05 to about 10 percent, by weight, relative to the co-solvent.

13. (Amended) The [process of claim 1] dielectric film of claim 8 wherein said water is present during said reaction in proportion to said monomer in a ratio ranging from about 0.50:1.5 to about 1.5:0.5, mole/mole.

14. (Amended) The [process of claim 1] dielectric film of claim 8 wherein said monomer compound is selected from the group consisting of said monomer compound is selected from the

group consisting of methyltriacetoxysilane, phenyltriacetoxysilane, tris(dimethylamino)methylsilane, tris(dimethylamino)phenylsilane, tris(diethylamino)methylsilane and combinations thereof.

15. (Amended) The [process of claim 1] dielectric film of claim 20 wherein the composition comprises an oligomer or polymer surface modification agent and a monomer surface modification agent, wherein said monomer is reactive with silanol groups on said silica film.

16. (Amended) The [process of claim 1] dielectric film of claim 20 wherein said silica film is pre-treated with a monomer surface modification agent, wherein said monomer is reactive with silanol groups on said silica film.

17. (Amended) The [process of claim 1] dielectric film of claim 8 further comprising adding at least one additional monomer to said solution after the water is fully reacted, wherein said monomer is reactive with silanol groups on said silica film.

18. (Amended) The [process of claim 1] dielectric film of claim 15 wherein the monomer surface modification agent is an selected from the group consisting of siloxanes, silazanes, silanes, carbosilanes and combinations thereof.

19. (Amended) The [process of claim 1] dielectric film of claim 15 wherein the monomer surface modification agent is selected from the group consisting of acetoxymethyltrimethylsilane, diacetoxymethyltrimethylsilane, methyltriacetoxysilane, phenyltriacetoxysilane, diphenyldiacetoxysilane, trimethylethoxysilane, trimethylmethoxysilane, 2-trimethylsiloxypent-2-ene-4-one, n-(trimethylsilyl)acetamide, 2-(trimethylsilyl) acetic acid, n-(trimethylsilyl)imidazole, trimethylsilylpropionate, trimethylsilyl(trimethylsiloxy)-acetate, nonamethyltrisilazane, hexamethyltrisilazane, hexamethyltrisiloxane, trimethylsilanol, triethylsilanol, triphenylsilanol, t-butyltrimethylsilanol, diphenylsilanediol, tris(dimethylamino)methylsilane, tris(dimethylamino)phenylsilane, tris(dimethylamino)silanemethyltrimethoxysilane, methyltris(methylethylkeoxime)silane. methyltrichlorosilane, and combinations thereof.

Cancel Claim 1.

CLEAN AMENDED CLAIMS

2. The dielectric film of claim 20 wherein said reaction is conducted in the presence of at least one solvent or co-solvent.
3. The dielectric film of claim 20 wherein said silica film is a nanoporous dielectric film having a pore structure that comprises silanols, and wherein said reaction is conducted for a period of time sufficient for said surface modification agent to produce a treated nanoporous silica film having a dielectric constant of about 3 or less.
4. The dielectric film of claim 3 that produces a nanoporous silica film having a dielectric constant ranging from about 1.1 to about 3.0.
5. The dielectric film of claim 20 wherein said reaction is conducted at a temperature ranging from about 10°C to about 300°C.
6. The dielectric film of claim 20 wherein said reaction is conducted for a time period ranging from about 10 seconds to about 1 hour.
7. The dielectric film of claim 20 wherein said surface modification agent is a polymer or oligomer that comprises functional groups that will react with silanols.
8. The dielectric film of claim 7 wherein said surface modification agent is prepared by reacting a suitable monomer with water in a solvent to form said surface modification agent.
9. The dielectric film of claim 2 wherein said solvent or co-solvent is selected from the group consisting of ethers, esters, ketones, glycol ethers, hydrocarbons, chlorinated solvents, low viscosity siloxanes and combinations thereof.
10. The dielectric film of claim 2 wherein said co-solvent is selected from the group consisting of ethers, esters, ketones, glycol ethers, hydrocarbons, chlorinated solvents, low viscosity siloxanes and combinations thereof.
11. The dielectric film of claim 8 wherein said monomer is selected from the group consisting of a siloxane, a silazane, a silane, a carbosilane, and combinations thereof.
12. The dielectric film of claim 8 wherein said water is present in said co-solvent in a concentration ranging from about 0.05 to about 10 percent, by weight, relative to the co-solvent.
13. The dielectric film of claim 8 wherein said water is present during said reaction in proportion to said monomer in a ratio ranging from about 0.50:1.5 to about 1.5:0.5, mole/mole.

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(cont)

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FOOTNOTES

14. The dielectric film of claim 8 wherein said monomer compound is selected from the group consisting of said monomer compound is selected from the group consisting of methyltriacetoxysilane, phenyltriacetoxysilane, tris(dimethylamino)methylsilane, tris(dimethylamino)phenylsilane, tris(diethylamino)methylsilane and combinations thereof.
15. The dielectric film of claim 20 wherein the composition comprises an oligomer or polymer surface modification agent and a monomer surface modification agent, wherein said monomer is reactive with silanol groups on said silica film.
16. The dielectric film of claim 20 wherein said silica film is pre-treated with a monomer surface modification agent, wherein said monomer is reactive with silanol groups on said silica film.
17. The dielectric film of claim 8 further comprising adding at least one additional monomer to said solution after the water is fully reacted, wherein said monomer is reactive with silanol groups on said silica film.
18. The dielectric film of claim 15 wherein the monomer surface modification agent is an selected from the group consisting of siloxanes, silazanes, silanes, carbosilanes and combinations thereof.
19. The dielectric film of claim 15 wherein the monomer surface modification agent is selected from the group consisting of acetoxyltrimethylsilane, diacetoxyltrimethylsilane, methyltriacetoxysilane, phenyltriacetoxysilane, diphenyldiacetoxysilane, trimethylethoxysilane, trimethylmethoxysilane, 2-trimethylsiloxypent-2-ene-4-one, n-(trimethylsilyl)acetamide, 2-(trimethylsilyl) acetic acid, n-(trimethylsilyl)imidazole, trimethylsilylpropionate, trimethylsilyl(trimethylsiloxy)-acetate, nonamethyltrisilazane, hexamethyldisilazane, hexamethyldisiloxane, trimethylsilanol, triethylsilanol, triphenylsilanol, t-butyltrimethylsilanol, diphenylsilanediol, tris(dimethylamino)methylsilane, tris(dimethylamino)phenylsilane, tris(dimethylamino)silanemethyltrimethoxysilane, methyltris(methylethylkeoxime)silane. methyltrichlorosilane, and combinations thereof.